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Value of the life course approach to the health care of older people

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Population ageing is a global phenomenon, and increasing numbers of people will now live into their sixties and beyond [1]. Understanding the link between ageing and health is of major importance, and Ben-Shlomo and colleagues have contributed critically to the field through life course epidemiology studies exploiting rich data from an array of birth and ageing cohorts as described in their review in this special issue[2]. The authors describe how the seminal work of David Barker from the 1980s focusing on the fetal and developmental origins of health and disease (DOHaD) was the catalyst for a revival in a life course approach to epidemiology, and they outline three key phases—the first focused on clinical disease end-points as exemplified by DOHaD, the second focused on an expansion of outcomes to include measures of physiological function, and the third focused on the application of life course epidemiology to the study of ageing. Of note, ageing was featured in early DOHaD research, as evidenced by innovative findings from the Hertfordshire Ageing Study (HAS), a birth cohort with historical records of early growth from the 1920s, which demonstrated that small size in early life was associated with markers of accelerated ageing across a range of body systems in later life[3]. This work led to a chapter describing a life course approach to biological ageing in the second edition of the original life course textbook[4].

The ageing markers studied in HAS included increased lens opacity, reduced hearing, thinner skin and lower hand grip strength; the latter has led to a series of studies investigating early influences on sarcopenia, the loss of skeletal muscle mass and function, with older age. Life course studies have subsequently demonstrated consistent relationships between low birth weight and lower muscle strength in later life[5,6], independent effects of pubertal growth on midlife grip strength,[7] and strong associations between body mass index from age 15[8] and life time physical activity[9], respectively, and strength in early old age. Interestingly, Ben-Shlomo and colleagues highlight the importance of identifying the consequences as well as the causes of functional change. Systematic reviews have now identified a range of adverse health outcomes associated with lower muscle strength across the life course, including increased disability, morbidity[10] and mortality[11]. Characterising lifetime functional trajectories is another important area identified. Because longitudinal data across the life course are not yet available for muscle strength, trajectories have been approximated by combining cross-sectional data from multiple cohorts with an age range of 4 – 90 years[12]. The ultimate availability of life course data on physical and cognitive function from prospective birth cohort studies such as the Southampton Women's Survey (SWS) is an exciting prospect. For example, grip strength was first collected at 4 years of age and is currently being collected in 11 – 13 year old

children participating in the SWS[13]. Representative cohorts recruited in mid and late life are also important, enabling findings to be translated into policy and practice in the shorter term.

Direct demonstration of the value of life course epidemiology to the health care of older people has been identified as a major challenge, but progress is now being made. For example, methodological advances in the UK have allowed linkage of birth cohort data from the Hertfordshire Cohort Study to routine National Health Service data on Hospital Episode Statistics, thereby facilitating research into the life course determinants of hospital admission. A recent novel finding is that low grip strength in community-dwelling older men and women predicts the likelihood of hospital admission during the following decade after adjustment for potential confounders[14]. This adds to existing evidence that grip strength measured on the day of admission to hospital is associated with the subsequent length of stay[15]. To improve the health and healthcare of older people, it will be necessary to translate the results of life course epidemiology focusing on aetiology to the development and evaluation of successful interventions. Much can be learned from clinical disciplines such as geriatric medicine where the results of longitudinal epidemiological studies have informed the development of interventions to improve functional outcomes in older persons.

A study from 1999, utilising data from two cohort studies, found that among community-living older persons, baseline vulnerability and precipitating hospital events contributed independently to the development of functional dependence, and proposed that each should be targeted for intervention[17]. However, it was noted that ascertaining the occurrence of disability using long assessment intervals could be problematic because of failure to account for the possibility of recovery or for deaths or losses to follow-up. A subsequent study comparing the rates of disability obtained from single follow-up assessments with those obtained from monthly assessments for intervals up to 24 months found that the occurrence of disability was substantially underestimated by longitudinal studies with long assessment intervals[18]. The primary reason for this is that disability is a dynamic process that is often characterised by repeated episodes of disability and recovery over discrete periods of time[19]. When trying to predict the occurrence or progression of disability, it is intuitively appealing to consider changes or trajectories in important risk factors, such as functional limitations, as suggested by Ben-Shlomo and colleagues, but there is evidence that changes in physical performance over time do not add useful prognostic information beyond that available from a single assessment[20].

Importantly for translational relevance, this observational research has been accompanied by intervention studies, including a ground-breaking trial showing the benefit of a home-based program targeting underlying impairments in physical abilities in preventing functional decline among physically frail, older people[21]. In the UK, life course epidemiology is also starting to be linked to intervention. The Hertfordshire Physical Activity Trial was an exploratory study that demonstrated the feasibility and acceptability of a 12-week aerobic exercise intervention in participants recruited from a birth cohort (the Hertfordshire Cohort Study); the intervention had a beneficial effect on the Timed Up and Go test but not grip strength[22]. Incorporating intervention studies into observational cohorts is an efficient approach but can potentially alter functional trajectories. Therefore this has to be taken into account when designing analysis strategies.

In summary, there are several promising avenues that will enhance the value of a life course approach to the health care of older people, including linkage of cohort data to routine data on health care, utilising insights from the clinical care of older people to answer important questions with translational relevance, and applying life course findings to the development and evaluation of interventions. These approaches can only enhance the already extensive contribution of life course epidemiology to the field of ageing research.

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References

1. World Report on Ageing and Health. World Health Organisation 2015.
2. Ben-Shlomo Y, Cooper R, Kuh D. Life course epidemiology: the last two decades and future directions. Int J Epidemiol In press.
3. Aihie Sayer A, Cooper C, Evans JR, Rauf A, Wormald RPL, Osmond C, Barker DJP. Are rates of aging determined in utero? Age Ageing 1998;27:579-583.
4. Aihie Sayer A, Cooper C. A life course approach to biological ageing. In: Ben-Shlomo Y, Kuh D eds. A life course approach to chronic disease epidemiology. Second edition. Oxford: OUP, 2004.
5. Sayer AA, Syddall HE, Gilbody HJ, Dennison EM, Cooper C. Does sarcopenia originate in early life ? Findings from the Hertfordshire Cohort Study. J Gerontol A Biol Sci Med Sci 2004;59(9):M930-4.
6. Dodds R, Denison HJ, Ntani G, Cooper R, Cooper C, Sayer AA, Baird J. Growth in early life and muscle strength : a systematic review and meta-analysis. JNHA 2012;16(7):609-15.
7. Kuh D, Hardy R, Butterworth S, Okell L, Wadsworth M, Cooper C, Aihie Sayer A. Developmental origins of midlife grip strength: findings from a birth cohort cohort study. J Gerontol A Biol Sci Med Sci 2006;61(7):702-706.
8. Cooper R, Hardy R, Bann D, Aihie Sayer A, Ward KA, Adams JE, Kuh D, MRC National Survey of Health and Development Scientific and Data Collection Team. Body mass index from age 15 years onwards and muscle mass, strength and quality in early old age: findings from the MRC National Survey of Health and Development. J Gerontol A Biol Sci Med Sci 2014; 69(10): 1253-9.
9. Dodds R, Kuh D, Aihie Sayer A, Cooper R. Physical activity levels across adult life and grip strength in early old age: updating findings from a British birth cohort. Age Ageing 2013; 42(6):794-798.
10. Cooper R, Kuh D, Cooper C, Gale CR, Lawlor DA, Matthews F, Hardy R, FALCon and HALCyon Study Teams. Objective measures of physical capability and subsequent health: a systematic review. Age Ageing 2011;40(1):14-23.
11. Cooper R, Kuh D, Hardy R, Mortality Review Group, FALCon and HALCyon Study Teams. Objectively measured physical capability levels and mortality: systematic review and meta-analysis. BMJ 2010;341:c4467.
12. Dodds RM, Syddall HE, Cooper R, Benzeval M, Deary IJ, Dennison EM, Der G, Gale CR, Inskip HM, Jagger C, Kirkwood TB, Lawlor DA, Robinson SM, Starr JM, Steptoe A, Tilling K, Kuh D,

Cooper C, Sayer A. Grip strength across the life course : normative data from twelve British studies. PLoS One 2014 ;9(12) :e113637.

13. Inskip HM, Godfrey KM, Robinson SM, Law CM, Barker DJ, Cooper C, SWS Study Group. Cohort profile : The Southampton Women's Survey. Int J Epidemiol 2006 ;35(1) :42-48.
14. Simmonds SJ, Syddall HE, Westbury LD, Dodds RM, Cooper C, Sayer AA. Grip strength among community-dwelling older people predicts hospital admission during the following decade. Age Ageing 2015 In press.
15. Kerr A, Syddall HE, Cooper C, Turner GF, Briggs RS, Sayer AA. Does admission grip strength predict length of stay in hospitalised older patients ? Age Ageing 2006 ; 35(1) :82-84.
16. Gill TM, Gahbauer EA, Han L, Allore HG. Trajectories of disability in the last year of life. New Eng J Med 2010;362(13):1173-1180.
17. Gill TM, Williams CS, Tinetti ME. The combined effects of baseline vulnerability and acute hospital events on the development of functional dependence among community-living older persons. J Gerontol Med Sci 1999;54A(7):M377-383.
18. Gill TM, Hardy SE, Williams CS. Underestimation of disability in community-living older persons. J Am Geriatr Soc 2002;50(9):1492-1497.
19. Gill TM, Kurland B. The burden and patterns of disability in activities of daily living among community-living older persons. J Gerontol A Biol Sci Med Sci. 2003;58:70-5.
20. Gill TM, Williams CS, Mendes de Leon CF, Tinetti ME. The role of change in physical performance in determining risk for dependence in activities of daily living among nondisabled community-living elderly persons. J Clin Epidemiol. 1997;50:765-72.
21. Gill TM, Baker DI, Gottschalk M, Peduzzi PN, Allore H, Byers A. A program to prevent functional decline in physically frail, elderly persons who live at home. New Eng J Med 2002;347(14):1068-1074.
22. Denison HJ, Syddall HE, Dodds R, Martin HJ, Finucane FM, Griffin SJ, Wareham NJ, Cooper C, Sayer AA. The effects of aerobic exercise on sarcopenia and physical performance among community dwelling older people from the Hertfordshire Cohort Study : a randomised controlled trial. JAGS 2013;61(6):1034-1036.